Innovation in AM: From feasibility to production in Laser Powder Bed Fusion

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Additive Manufacturing is around for more than 20 years in different forms from rapid prototyping of samples to printing of demonstration parts and has finally reached series production of functional parts. The increase in technology readiness opens new application areas where ideas are not simply brought into a design at the ease of a mouse klick.

L-PBF for metals requires a combination of creativity and expert knowledge at design stage to bring about products that integrate functionality to make use of the technology's degrees of freedom. The Integrated Design and Decision Support tool is being developed in the EU project ENCOMPASS to enable designers to test their construction against an expert knowledge. It greatly accelerates the development process from design to printing by an instant assessment of production problems. Under the umbrella of the AMable project, 16 of the most renowned research institutes have teamed up to support SMEs in experimenting with their design ideas. In the so-called AMable Services Arena, SMEs can use external competences to complement their knowledge for an accelerated development of their idea towards a functional additively manufactured prototype. Therein, AMable offers a complete digital data chain with a secure end to end transmission to support safe data handling between collaborating entities.

When it comes to production, systems still lack integrated quality monitoring capability. Most industrial machines today contain sensors that monitor emission of the process by means of photo diodes, pyrometers or camera systems [1,2]. Although these systems produce a vast amount of data, the identification of process deviations still remains a challenge. A novel approach is to observe build behaviour of critical features such as support structures, thin walls or overhangs. These critical sections are tracked through a dedicated feature based monitoring strategy. Based on a laboratory system implementation, a pyrometric sensor system is used to record the melt pool emission through a fully integrated coaxial monitoring system which avoids the f-theta optics of other experiments [3,4]. The recorded signals are related to expected melting behaviour in specific regions of the parts which enables the detection of defects in support structures and delamination. This demonstrates a first implementation of a combined processing and monitoring system that directly identifies a first set of defects during the process. Parts of the work are co-funded by the European Commission in the ENCOMPASS project and the AMable project.

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